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Preface

The first major gathering of people interested in discussing natural paradigms and their application to solve real-world problems in Europe took place at Dortmund, Germany, in 1990. What was planned originally as a small workshop with about 30 participants finally grew into an international conference named Parallel Problem Solving from Nature (PPSN) with more than 100 participants. The interest in the topics of the conference has increased steadily ever since leading to the pleasant necessity of organizing PPSN conferences biennially within the European region. After visiting Brussels (1992), Jerusalem (1994), Berlin (1996), Amsterdam (1998), Paris (2000), Granada (2002), Birmingham (2004), and Reykjavik (2006), PPSN returned to its birthplace in Dortmund to celebrate its 10th anniversary in 2008.

Without any doubt the PPSN conference series evolved to be one of the most respected and highly regarded conferences on natural computing. Therefore we are very pleased to present the proceedings of the 10th International Conference on Parallel Problem Solving from Nature (PPSN X) to the scientific community. This year we received 206 submissions with authors from 26 countries spread over Africa, America, Asia, Australia and Europe. From these submissions the Program Chairs selected the top 114 papers after an extensive peer-review process. Not all decisions were easy to make but in all cases we benefited greatly from the careful reviews provided by the international Program Committee. We requested four reviews for each submission leading to a total of 824 requests for reviews. Thanks to these reviews we were able to decide about acceptance on a solid basis.

The papers included in these proceedings have been assigned to six fuzzy clusters (formal theory, new techniques, experimental analysis, multiobjective optimization, hybrid methods, and applications) that can hardly reflect the true variety of research topics presented in the proceedings at hand. Following the tradition and spirit of PPSN, all papers were presented as posters. The 8 poster sessions consisting of about 14 papers each were compiled orthogonally to the fuzzy clusters mentioned above to cover the range of topics as widely as possible. As a consequence, participants with different interests would find some relevant papers in every session and poster presenters were able to discuss related work in sessions different to their own. As usual, the conference also included one day with workshops (Saturday), one day with tutorials (Sunday), and three invited plenary talks (Monday to Wednesday) for free.

Needless to say, the success of such a conference depends on authors, reviewers, and organizers. We are grateful to all authors for submitting their best and latest work, to all the reviewers for the generous way they spent their time and provided their valuable expertise in preparing these reviews, to the workshop organizers and tutorial presenters for their valorizing contributions to the conference event, and to the local organizers who helped to make PPSN X happen.

Last but not least, we would like to thank the Collaborative Research Center 'Computational Intelligence' (SFB 531) at the Dortmund University of Technology and the Deutsche Forschungsgemeinschaft (DFG) for financial support as well as the Gesellschaft für Informatik (GI) for administrative support in international monetary transactions.

July 2008

Günter Rudolph
Thomas Jansen
Simon Lucas
Carlo Poloni
Nicola Beume

Organization

PPSN X was organized and hosted by the Computational Intelligence Group of the Lehrstuhl für Algorithm Engineering, Fakultät für Informatik, Technische Universität Dortmund (TU Dortmund), Germany. The conference took place in the Kongresszentrum Westfalenhallen, Dortmund.

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Theory of Randomized Search Heuristics 2008
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Christian Blum

Multiobjective Evolutionary Algorithms
Eckart Zitzler

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Games
Simon Lucas

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Thomas Bartz-Beielstein and Mike Preuss

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Frank Neumann and Carsten Witt

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Nikolaus Hansen and Anne Auger

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Gesellschaft für Informatik (GI), Germany

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On the Behaviour of the (1+1)-ES for a Simple Constrained Problem

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Abstract. This paper studies the behaviour of the $(1 + 1)$-ES when applied to a linear problem with a single linear constraint. It goes beyond previous work by considering constraint planes that do not contain the gradient direction. The behaviour of the distance of the search point from the constraint plane forms a Markov chain. The limit distribution of that chain is approximated using an exponential model, and progress rates and success probabilities are derived. Consequences for the working of step length adaptation mechanisms based on success probabilities are discussed.

1 Introduction

Constraint handling is an important aspect of numerical optimisation. See [6, 7, 10, 11, 14] and the references therein for examples of constraint handling techniques that have been proposed in connection with evolution strategies. The performance of new techniques is commonly evaluated using large and diverse sets of test functions, such as the benchmark set compiled for the *CEC 2006 Special Session on Constrained Real-Parameter Optimization* [8]. Moreover, the evaluation criteria used are relatively complex and involve various parameters, such as the number of function evaluations allowed and different quality thresholds. As a result, the observed outcomes are not always easy to interpret.

In contrast, in the realm of unconstrained optimisation there is a significant body of work employing simple test functions that aims at arriving at a better understanding of the behaviour of evolution strategies. See [1, 2, 5, 13] for examples and further references. Starting from the simplest non-trivial strategies and optimisation environments, the complexity of the scenarios studied has increased over time, and today results are available for adaptive strategies and problems with various degrees of ill-conditioning. The approach complements observations for large and difficult test beds with results that are easy to interpret, and that reveal scaling properties and the influence of parameters on optimisation performance.

The *Handbook of Evolutionary Computation* [3, page B2.4:**11**f] lists a small number of studies that use simple test functions and derive analytical results in the realm of constrained optimisation with evolution strategies. Rechenberg [12]

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